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Philip D. Askenazy, Reg. No. 56,721

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant: Steven Don Arnold	
Serial No. 10/647,046	
Filed: March 5, 2003	**Group Art Unit: 3748**
For: Low Speed Turbo EGR	Examiner: Thai Ba Trieu

APPEAL BRIEF FOR APPELLANT UNDER 37 CFR § 41.37

Applicants respectfully submit their Appeal Brief in support of the captioned patent application.

I. REAL PARTIES IN INTEREST

The real parties in interest are Honeywell International Inc., the assignee of record, and its subsidiary Garrett Engine Boosting Systems.

II. RELATED APPEALS AND INTERFERENCES

There are no appeals, interferences, or judicial proceedings related to this appeal or which may affect or be affected by this appeal.

III. STATUS OF CLAIMS

Claims 1, 3-9, 11-17, and 19-20 are pending in the case, stand finally rejected, and form the subject matter of this appeal. Original claims 2, 10, and 18 are canceled.

IV. STATUS OF AMENDMENTS

No amendments have been filed or entered subsequent to the final rejection.

V. SUMMARY OF CLAIMED SUBJECT MATTER

There are three independent claims involved in this appeal; claims 1 and 13 are directed to an "Exhaust Gas Recirculation (EGR) system", and claim 16 is directed to a "method of providing exhaust gas recirculation to an internal combustion engine." There are no means-plus-function or step-plus-function claims.

The apparatus of claim 1 is shown in drawing Fig. 1 and its accompanying description in the specification from page 4, line 28 to page 6, line 19. The EGR system comprises turbocharger **100**, which includes compressor **80** with more than one stage, wherein intake air **40** is compressed in at least one first stage **34** of compressor **80**, and a mixture of the compressed intake air and exhaust gas is formed by EGR mixer **46**, which exhaust gas has not passed through a turbine, is compressed in at least one second stage **36** of compressor **80**; a diesel particulate filter **52** disposed to filter the exhaust gas; and EGR cooler **54** disposed to receive filtered

exhaust gas from diesel particulate filter **52** before the filtered exhaust gas enters the compressor **80**.

The apparatus of claim 13 is also shown in Figure 1 and described in the specification from page 5, line 26 to page 6, line 4. Turbocharger **100** maintains a pressure of cooled exhaust gas which has been previously filtered (in EGR loop line **50**) at an intermediate pressure lower than a pressure at intake manifold **16** of engine **14**, wherein said intermediate pressure is greater than a pressure of intake air **40**, the intake air having been compressed by first stage **34** of two stage compressor **80** before being mixed with the filtered exhaust gas in EGR mixer **46**.

The method of claim 16 is described in the specification from page 5, line 26, to page 6, line 13. The claimed steps of the method are: maintaining a pressure of cooled exhaust gas produced by the engine, which gas has been previously filtered and which has not passed through a turbine at a first intermediate pressure less than a pressure at an intake manifold of the engine; increasing a pressure of intake air to a second intermediate pressure; mixing the exhaust gas and pressurized intake air to form a mixture; and boosting the pressure of the mixture to a pressure sufficient to meet a mass flow demand of the engine.

VI. GROUNDS OF REJECTION TO BE REVIEWED

(a) Claims 16-17 and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,062,026 to Woollenweber et al. in view of U.S. Patent No. 5,771,868 to Khair.

(b) Claims 1, 3, 5-9, and 11-15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,301,889 to Gladden et al. in view of Woollenweber et al. and further in view of Khair.

(c) Claims 1 and 3 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Gladden et al. in view of Woollenweber et al.

(d) Claim 4 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Gladden et al. in view of Woollenweber et al. and further in view of U.S. Patent No. 6,205,785 to Coleman.

(e) Claim 20 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Woollenweber et al., in view of Khair, in view of Gladden et al.

VII. ARGUMENT

A. Rejection of claims 16-17 and 19 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,062,026 to Woollenweber et al. in view of U.S. Patent No. 5,771,868 to Khair.

(i) Claims 16-17

According to MPEP Section 2143.01, if the combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). The EGR gas of Khair must be brought down to ambient pressure

to be combined with the fresh inlet air via valve **35** (see FIG. 1, col. 4 lines 39-43, and col. 5, lines 25-27). The *mixture* is then compressed by compressor **22**. In contrast, Woollenweber et al. teach that ambient air is first compressed by compressor **18** *before* being combined with the cooled EGR in mixing valve **35**. Thus in each case the pressure of the exhaust gas is different when it is mixed with the fresh intake air. Because Khair teaches mixing the exhaust gas with the inlet air *before* the inlet air is compressed, combining the system of Khair with that of Woollenweber et al., both of which teach that the inlet air is mixed with the exhaust gas *after* it is compressed, would change the principle of operation of each reference. Thus the references may not properly be combined.

Further, on page 9 of the Final Office Action dated August 3, 2005, the Examiner stated that "it is the examiner's position that the positioning of the diesel particulate filter before the intercooler in the above claimed positions would have been obvious to one having ordinary skill in the art. More specifically, one having ordinary skill in the art would have positioned the diesel particulate filter at any position in the EGR system in order that the exhaust gas needs to be cleaned/filtered before being delivered back to the engine." In this statement the Examiner relies upon what he considers "common knowledge in the art". However, this statement is inaccurate, and inappropriate under MPEP 2144.03(A) due to the lack of documentary evidence presented.

As remarked by Applicant in the office action response filed on January 14, 2005, "the inventor has discovered that it is advantageous to filter the exhaust before it is cooled, because the filter efficiency is dramatically increased at higher temperature. This is especially important in the context of the present invention, since the EGR particulate level must be very low in order

to avoid damage to the rotating compressor wheel." There is no suggestion whatsoever in Khair, which is the only cited reference that discloses a filter disposed before the EGR cooler, that the position of the filter is important. Indeed, as clearly shown in the figures, the filter **29** of Khair and filter **41** of Woollenweber et al. are *optional*; there is no understanding of the importance of filter efficiency or compressor damage as discovered by the present inventor. While not cited in the present rejection, Gladden et al. is yet another example of the level of knowledge in the art at the time the present invention was made. Gladden et al. do not disclose a filter at all; they use fluid wash injector **84**, positioned well after the cooler (indeed, positioned even after the EGR stream is mixed with intake air), to lessen fouling of downstream components. Finally, Coleman (not cited in this rejection) does not disclose a filter or the need for any filtration at all.

Applicant therefore submits that Examiner's statement above is not considered to be common knowledge or well-known in the art. Thus, according to MPEP Sections 2144.03(B) and (C), the Examiner must present adequate documentary evidence supporting the Examiner's statement, which the Examiner has not done.

For these reasons, Applicant submits that claims 16-17 are allowable over the cited references.

(i) <u>Claim 19</u>

The initial argument for claim 19 is the same as that presented above for claims 16-17. Further, neither Woollenweber et al. nor Khair teach a two stage compressor. Thus all claim limitations are not taught or suggested by said combination of the prior art, which is required for

establishing *prima facie* obviousness per MPEP Section 2143.03. Thus claim 19 is allowable over the cited references.

B. Rejection of Claims 1, 3, 5-9, and 11-15 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,301,889 to Gladden et al. in view of Woollenweber et al. and further in view of Khair.

Appellant's argument with respect to this rejection is similar to that presented in (A) above, the distinction being that Gladden et al., similar to Woollenweber et al., teach that ambient air **86** is first compressed by blades **50** of compressor wheel **46** *before* being combined with the EGR gas in interstage duct **64** (see FIG. 1 and col. 4, line 49- col. 5, line 12).

For those reasons, Applicant submits that claims 1, 3, 5-9, and 11-15 are allowable over the cited references.

(C) Rejection of claims 1 and 3 under 35 U.S.C. § 103(a) as being unpatentable over Gladden et al. in view of Woollenweber et al.

Neither Woollenweber et al. or Gladden et al. disclose a filter disposed prior to the EGR cooler, as required by claim 1. Thus, all claim limitations are not taught or suggested by said combination of the prior art, which is required for establishing *prima facie* obviousness per MPEP Section 2143.03.

Further, Appellant's argument in (A) above regarding the Examiner's assertion that "the positioning of the diesel particulate filter before the intercooler in the above claimed positions would have been obvious to one having ordinary skill in the art" is also applicable with respect to the present rejection.

Finally, according to MPEP Section 2144.04 VI(C), "The mere fact that a worker in the art could rearrange the parts of the reference device to meet the terms of the claims on appeal is not by itself sufficient to support a finding of obviousness. The prior art must provide a motivation or reason for the worker in the art, without the benefit of appellant's specification, to make the necessary changes in the reference device." *Ex parte Chicago Rawhide Mfg. Co.*, 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984). Nothing in the cited art provides motivation or reason to place the exhaust gas filter before the EGR cooler.

For these reasons, Applicant submits that claims 1 and 3 are allowable over the cited references.

(D) Rejection of Claim 4 under 35 U.S.C. § 103(a) as being unpatentable over Gladden et al. in view of Woollenweber et al. and further in view of U.S. Patent No. 6,205,785 to Coleman.

Applicant's argument with respect to this rejection is essentially the same as that in (C) above, the distinction being that, like the other cited references, Coleman as well does not disclose a filter disposed prior to the EGR cooler, as required by claim 1.

For those reasons, Applicant submits that claim 4 is allowable over the cited references.

(E) Rejection of Claim 20 under 35 U.S.C. § 103(a) as being unpatentable over Woollenweber et al., in view of Khair, in view of Gladden et al.

Applicant's argument for this rejection is essentially identical to that in (B) above.

For those reasons, Applicant submits that claim 20 is allowable over the cited references.

VIII. CONCLUSION

Appellant respectfully requests that the rejections of all pending claims be reversed.

IX. APPENDICES

1. Claims Appendix (attached)
2. Evidence Appendix (none; not applicable)
3. Related Proceedings Appendix (none; not applicable)

Dated this 7th day of February, 2006.

Respectfully submitted,

By _____
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CLAIMS APPENDIX

1. An Exhaust Gas Recirculation (EGR) system providing a mixture of exhaust gas and intake air to the intake of an internal combustion engine, the system comprising:

a turbocharger including a compressor with more than one stage, wherein intake air is compressed in at least one first stage of the compressor, and a mixture of the compressed intake air compressed in the at least one first stage of the compressor and exhaust gas, which exhaust gas has not passed through a turbine, is compressed in at least one second stage of the compressor;

a diesel particulate filter disposed to filter the exhaust gas; and

an EGR cooler disposed to receive filtered exhaust gas from the diesel particulate filter before the filtered exhaust gas enters the compressor.

2. (canceled)

3. The EGR system of claim 1 wherein the compressor has two stages.

4. The EGR system of claim 1 wherein the turbocharger is a variable geometry turbocharger.

5. The EGR system of claim 1 further comprising a control valve which determines the proportion of exhaust gas produced by the engine to be recirculated.

6. The EGR system of claim 1 further comprising an EGR mixer to mix the exhaust gas with intake air to form the mixture.

7. The EGR system of claim 6 wherein the intake air is compressed by at least one first stage of the turbocharger to achieve a first intermediate pressure, the first intermediate pressure being less than an intake pressure at an intake manifold of the engine, and wherein back pressure from a turbocharger turbine maintains a pressure of the exhaust gas at a second intermediate pressure, the second intermediate pressure being less than an intake pressure at an intake manifold of the engine.

8. The EGR system of claim 1 wherein the turbocharger comprises:

a turbine inlet receiving exhaust gas from an exhaust manifold of an internal combustion engine and a turbine exhaust outlet, and a compressor having an air inlet and a first volute;

a turbine wheel extracting energy from the exhaust gas, said turbine wheel connected to a shaft;

a bearing supporting the shaft for rotational motion; and

a compressor impeller connected to the shaft opposite the turbine wheel, said compressor impeller having a first plurality of impeller blades mounted on a front face proximate the air inlet, said first plurality of blades increasing the velocity of air from the air inlet and exhausting air into the first volute, said compressor impeller also having a second plurality of impeller blades mounted on a back face, said second plurality of blades increasing the velocity of air from a scroll inlet connected to the first volute and a source of exhaust gas, and exhausting the mixture of exhaust gas and air into a second volute having a charge air outlet connected to the engine intake.

9. The EGR system of claim 8 wherein the second plurality of impeller blades compresses the mixture to a pressure required by the engine to transit a desired mass flow.

10. (canceled)

11. The EGR system of claim 1 further comprising at least one air/air charge cooler disposed to receive the mixture of intake air and exhaust after it is compressed in the second stage of the compressor.

12. The EGR system of claim 1 further comprising at least one emissions control device.

13. An EGR system for an internal combustion engine wherein a turbocharger maintains a pressure of cooled exhaust gas which has been previously filtered at an intermediate pressure lower than a pressure at an intake manifold of the engine, wherein said intermediate pressure is greater than a pressure of intake air, the intake air having been compressed by a first stage of a two stage compressor before being mixed with the filtered exhaust gas.

14. The EGR system of claim 13 wherein the compressor forms a part of a turbocharger.

15. The EGR system of claim 14 wherein the exhaust gas and the intake air are mixed together to form a mixture, and the mixture is further compressed by a second stage of the two stage compressor until the mixture reaches a pressure sufficient to meet a mass flow demand of the engine.

16. A method of providing exhaust gas recirculation to an internal combustion engine comprising the steps of:

maintaining a pressure of cooled exhaust gas produced by the engine, which gas has been previously filtered and which has not passed through a turbine at a first intermediate pressure less than a pressure at an intake manifold of the engine;

increasing a pressure of intake air to a second intermediate pressure;

mixing the exhaust gas and pressurized intake air to form a mixture; and

boosting the pressure of the mixture to a pressure sufficient to meet a mass flow demand of the engine.

17. The method of claim 16 wherein the maintaining step comprises using back pressure from a turbocharger turbine.

18. (canceled)

19. The method of claim 16 wherein the increasing step comprises compressing the intake air with a first stage of a two stage compressor.

20. The method of claim 16 wherein the boosting step comprises compressing the mixture using the second stage of a two stage compressor of a turbocharger, wherein the turbocharger comprises:

turbine inlet receiving exhaust gas from an exhaust manifold of an internal combustion engine and a turbine exhaust outlet, and a compressor having an air inlet and a first volute;

a turbine wheel extracting energy from the exhaust gas, said turbine wheel connected to a shaft;

a bearing supporting the shaft for rotational motion;

a compressor impeller connected to the shaft opposite the turbine wheel, said compressor impeller having a first plurality of impeller blades mounted on a front face proximate the air inlet, said first plurality of blades increasing the velocity of air from the air inlet and exhausting air into the first volute, said compressor impeller also having a second plurality of impeller blades mounted on a back face, said second plurality of blades increasing the velocity of air from a scroll inlet connected to the first volute and a source of exhaust gas, and exhausting the mixture of exhaust gas and air into a second volute having a charge air outlet connected to the engine intake.